

CLAIMS

1. A watermark signal generating apparatus for generating watermark signals to be embedded as a digital watermark in real-time contents, the watermark signal generating apparatus comprising:

 input means for inputting the real-time contents;
 an input buffer for storing the real-time contents;
 generation means for generating, from the real-time contents, watermark signals to be outputted corresponding to predicted intensities of the real-time contents; and
 an output buffer for storing the generated watermark signals to be outputted,

 wherein the generation means includes:

 prediction means for predicting intensities of the watermark signals from prediction of perceptual stimulation values of the real-time contents after a predetermined lapse of time;

 control means for controlling embedding by use of a message to be embedded as a digital watermark in the real-time contents; and

 means for generating the watermark signals to be outputted by use of outputs from the prediction means and outputs from the control means.

2. The watermark signal generating apparatus according to claim 1,

 wherein the perceptual stimulation values represent amplitude of sound or luminance, and

 the prediction means generates a predicted inaudible amount or a predicted invisible amount of watermark signals corresponding to intensities of the real-time contents after the predetermined lapse of time by use of data stored in the input buffer.

3. The watermark signal generating apparatus according to

any one of claims 1 and 2,

wherein the control means includes means for generating a value to be embedded, which is a binary based on a positive and a negative, by use of a secret key, the message and a pseudo-random number.

4. The watermark signal generating apparatus according to any one of claims 1 to 3, further comprising output controlling means for controlling outputs from the output buffer by comparing the generated watermark signals with the real-time contents after a time needed to embed the generated watermark signals has passed.

5. The watermark signal generating apparatus according to any one of claims 1 to 4,

wherein the input means includes means for dividing, and inputting, the real-time contents, and

the generation means generates watermark signals by use of the divided real-time contents.

6. A watermark signal generating method for generating watermark signals to be embedded as a digital watermark in real-time contents, the method comprising the steps of:

inputting the real-time contents;

storing the real-time contents;

generating, from the real-time contents, watermark signals to be outputted corresponding to predicted intensities of the real-time contents; and

storing the generated watermark signals to be outputted,

wherein the generation step includes the steps of:

predicting intensities of the watermark signals from prediction of perceptual stimulation values of the real-time contents after a predetermined lapse of time;

controlling embedding by use of a message to be embedded as a digital watermark in the real-time contents; and

generating the watermark signals to be outputted by use

of outputs from the prediction step and outputs from the control step.

7. The watermark signal generating method according to claim 6,

wherein the perceptual stimulation values represent sound or luminance, and

the prediction step includes a step of generating a predicted inaudible amount or a predicted invisible amount of watermark signals corresponding to intensities of the real-time contents after the predetermined lapse of time by use of data stored in the step of storing the real-time contents.

8. The watermark signal generating method according to any one of claims 6 and 7,

wherein the control step includes a step of generating a value to be embedded, which is a binary based on a positive and a negative, by use of a secret key, the message and a pseudo-random number.

9. The watermark signal generating method according to any one of claims 6 to 8, further comprising a step of controlling outputs from the step of storing the generated watermark signals to be outputted, by comparing the generated watermark signals with the real-time contents after a time needed to embed the generated watermark signals has passed.

10. The watermark signal generating method according to any one of claims 6 to 9,

wherein the input step includes a step of dividing the real-time contents, and

the generation step includes a step of generating the watermark signals by use of the divided real-time contents.

11. A program for causing a watermark signal generating method to be executed, the program being computer-executable

one for causing a computer to execute the method for generating watermark signals to be embedded as a digital watermark in real-time contents, the program causing the computer to execute the steps of:

storing the real-time contents which have been inputted; generating, from the real-time contents, watermark signals to be outputted corresponding to predicted intensities of the real-time contents; and

storing the generated watermark signals to be outputted, wherein the generation step includes the steps of:

predicting intensities of the watermark signals from prediction of perceptual stimulation values of the real-time contents after a predetermined lapse of time;

controlling embedding by use of a message to be embedded as a digital watermark in the real-time contents; and

generating the watermark signals to be outputted, by use of outputs from the prediction step and outputs from the control step.

12. The program according to claim 11,

wherein the perceptual stimulation values represent sound or luminance, and

the prediction step includes a step of generating a predicted inaudible amount or a predicted invisible amount of watermark signals corresponding to intensities of the real-time contents after the predetermined lapse of time by use of data stored in the step of storing the real-time contents which have been inputted.

13. The program according to any one of claims 11 and 12,

wherein the real-time contents which have been divided and inputted are used in the generation step, and

the control step includes a step of generating a value to be embedded, which is a binary based on a positive and a negative, by use of a secret key, the message and a pseudo-random number.

14. The program according to any one of claims 11 to 13, further comprising a step for controlling outputs from the step of storing the generated watermark signals to be outputted, by comparing the generated watermark signals with the real-time contents after a time needed to embed the generated watermark signals has passed.

15. A computer-readable storage medium, in which a computer-executable program for causing a computer to execute a method for generating watermark signals to be embedded as a digital watermark in real-time contents is stored, wherein the program causes the computer to execute the steps of:

storing the inputted real-time contents;

generating, from the real-time contents, watermark signals to be outputted corresponding to predicted intensities of the real-time contents; and

storing the generated watermark signals to be outputted, wherein the generation step includes the steps of:

predicting intensities of the watermark signals from prediction of perceptual stimulation values of the real-time contents after a predetermined lapse of time;

controlling embedding by use of a message to be embedded as a digital watermark in the real-time contents; and

generating the watermark signals to be outputted, by use of outputs from the prediction step and outputs from the control step.

16. The storage medium according to claim 15, wherein the perceptual stimulation values represent sound or luminance, and

the prediction step includes a step of generating a predicted inaudible amount or a predicted invisible amount of watermark signals corresponding to intensities of the real-time contents after the predetermined lapse of time, by

use of data stored in the step of storing the real-time contents.

17. The storage medium according to any one of claims 15 and 16,

wherein the real-time contents which have been divided and inputted are used in the generation step, and

the control step includes a step of generating a value to be embedded, which is a binary based on a positive and a negative, by use of a secret key, the message and a pseudo-random number.

18. The storage medium according to any one of claims 15 to 17, further comprising a step for controlling outputs from the step of storing the generated watermark signals to be outputted, by comparing the generated watermark signals with the real-time contents after a time needed to embed the generated watermark signals has passed.

19. A digital watermark embedding apparatus for embedding a digital watermark in real-time contents, the apparatus comprising:

input means for inputting the real-time contents;
an input buffer for storing the real-time contents;
generation means for generating, from the real-time contents, watermark signals to be outputted corresponding to predicted intensities of the real-time contents;

an output buffer for storing the generated watermark signals to be outputted; and

embedding means for receiving the generated watermark signals, and for embedding the generated watermark signals in the real-time contents,

wherein the generation means includes:

prediction means for predicting intensities of the watermark signals from prediction of perceptual stimulation values of the real-time contents after a predetermined lapse of time;

control means for controlling embedding by use of a message to be embedded as a digital watermark in the real-time contents; and

means for generating the watermark signals to be outputted, by use of outputs from the prediction means and outputs from the control means.

20. The digital watermark embedding apparatus according to claim 19,

wherein the perceptual stimulation values represent sound or luminance, and

the prediction means generates a predicted inaudible amount or a predicted invisible amount of watermark signals corresponding to intensities of the real-time contents after the predetermined lapse of time by use of data stored in the input buffer.

21. The digital watermark embedding apparatus according to any one of claims 19 and 20,

wherein the control means includes means for generating a value to be embedded, which is a binary based on a positive and a negative, by use of a secret key, the message and a pseudo-random number.

22. The digital watermark embedding apparatus according to any one of claims 19 to 21, further comprising output controlling means for controlling outputs from the output buffer by comparing the generated watermark signals with the real-time contents after a time needed to embed the generated watermark signals has passed.

23. The digital watermark embedding apparatus according to any one of claims 19 to 22,

wherein the input means includes means for dividing and inputting the real-time contents, and

the generation means generates watermark signals by use

of the divided real-time contents.

24. The digital watermark embedding apparatus according to any one of claims 19 to 23,

wherein the real-time contents are music to be played live.

25. The digital watermark embedding apparatus according to any one of claims 19 to 24,

wherein the real-time contents are broadcast contents to be broadcast live.

26. The digital watermark embedding apparatus according to any one of claims 19 to 25,

wherein the digital watermark embedding apparatus is included in an external device of a digital television apparatus or in the digital television apparatus.

27. A digital television apparatus, comprising:

means for receiving a digital broadcast, for decoding the digital broadcast, and for generate the real-time contents;

display means for displaying the generated real-time contents; and

a digital watermark embedding apparatus for embedding a digital watermark in the decoded real-time contents,

wherein the digital watermark embedding apparatus includes:

input means for inputting the real-time contents;

an input buffer for storing the real-time contents;

generation means for generating, from the real-time contents, wartermark signals to be outputted, corresponding to predicted intensities of the real-time contents;

an output buffer for storing the generated wartermark signals to be outputted; and

embedding means for receiving the generated wartermark signals to be outputted, and for embedding the generated

watermark signals to be outputted in the real-time contents, wherein the generation means includes:

prediction means for predicting intensities of the watermark signals from prediction of perceptual stimulation values of the real-time contents after a predetermined lapse of time;

control means for controlling the embedding by use of a message to be embedded as a digital watermark in the real-time contents; and

means for generating the watermark signals to be outputted, by use of outputs from the prediction means and outputs from the control means.

28. The digital television apparatus according to claim 27, wherein the digital watermark embedding apparatus is included in an external device of the digital television apparatus or in the digital television apparatus.

29. The digital television apparatus according to any one of claims 27 and 28,

wherein the input means includes division means, and the control means controls the embedding by use of the message and a secret key.